Claims

[c1] A method for formation evaluation results from a multi-dimensional representation of nuclear magnetic resonance data, the method comprising the steps of:
Obtaining a set of NMR data for a fluid sample;
Computing from the set of NMR data a multi-dimensional distribution using a mathematical inversion independent of prior knowledge of fluid sample properties;
Displaying the multi-dimensional distribution as an at least two-axis graph;
Identifying at least one fluid instance on the graph representing a probable existence of a detected fluid; and
Computing a quantitative formation evaluation value for the at least one fluid instance based on the multi-dimensional distribution associated with the at least one fluid instance.

[c2] The method of claim 1, wherein the computing a quantitative formation evaluation value further comprises the step of:
Applying a model dependent inversion to calculate quantitative formation evaluation values of the fluid

sample, the model dependent inversion being based on the at least one fluid instance.

[c3] The method of claim 1, wherein the computing a quantitative formation evaluation value further comprises the step of:
Integrating over a region of the graph associated with the at least one fluid instance to obtain a total amplitude.

[c4] The method of claim 1, wherein the computing a quantitative formation evaluation value further comprises the step of:
Eliminating from the graph fluid instances representing a probable existence of a detected fluid such that no more than two fluid instances are visible;
Computing a mean value across a region of the distribution associated with the at least one fluid instance;
Computing a quantitative formation evaluation value based on the computed mean value.

[c5] The method of claim 1, wherein the mathematical inversion is based on a maximum entropy process.

[c6] The method of claim 1, wherein the multi-dimensional distribution is displayed along a fluid diffusion axis and a T_2 relaxation axis.

[c7] The method of claim 5, wherein the graph includes an overlay with ideal diffusion and T_2 relaxation values.

[c8] The method of claim 1, wherein the steps of identifying, integrating and computing quantitative formation evaluation values is repeated for additional fluid instances.

[c9] A method for determining quantitative formation evaluation results from a multi-dimensional representation of nuclear magnetic resonance data, the method comprising the steps of:

Obtaining a set of NMR data for a fluid sample;

Computing from the set of NMR data a multi-dimensional distribution using a mathematical inversion independent of prior knowledge of fluid sample properties;

Displaying the multi-dimensional distribution as an at least two-axis graph;

Identifying at least one fluid instance on the graph representing a probable existence of a detected fluid; and

Applying a fluid response model to calculate quantitative formation evaluation values of the fluid sample, the fluid response model being based on the at least one fluid instance.

[c10] The method of claim 9, wherein the mathematical inver-

sion is based on a maximum entropy process.

[c11] The method of claim 9, wherein the multi-dimensional distribution is displayed along a fluid diffusion axis and a T_2 relaxation axis.

[c12] The method of claim 11, wherein the graph includes an overlay with ideal diffusion and T_2 relaxation values.

[c13] The method of claim 11, wherein the identifying step further comprises the step of:
Determining a diffusion value associated with the at least one fluid instance; and
Determining a fluid type associated with the at least one fluid instance.

[c14] The method of claim 13, wherein the model is in part based on the diffusion value and the fluid type.

[c15] The method of claim 9, further comprising the step of identifying for additional fluid instances.

[c16] The method of claim 9, wherein the formation evaluation values are quantitative values associated with the fluid instance of at least one of fluid volume, saturation, viscosity, porosity, and permeability.

[c17] A method for determining quantitative formation evaluation results from a multi-dimensional representation of

nuclear magnetic resonance data, the method comprising the steps of:

Obtaining a set of NMR data for a fluid sample;

Computing from the set of NMR data a multi-dimensional distribution using a mathematical inversion independent of prior knowledge of fluid sample properties;

Displaying the multi-dimensional distribution as an at least two-axis graph;

Identifying at least one fluid instance on the graph representing a probable existence of a detected fluid;

Integrating over a region of the graph associated with the at least one fluid instance to obtain a total amplitude; and

Computing quantitative formation evaluation values associated with the at least one fluid instance using the total amplitude.

[c18] The method of claim 17, wherein the mathematical inversion is based on a maximum entropy process.

[c19] The method of claim 17, wherein the multi-dimensional distribution is displayed along a fluid diffusion axis and a T_2 relaxation axis.

[c20] The method of claim 19, wherein the graph includes an overlay with ideal diffusion and T_2 relaxation values.

[c21] The method of claim 19, wherein the region is selected to encompass substantially all portions of the graph having a positive amplitude and associated with the fluid instance.

[c22] The method of claim 19, wherein the region is selected automatically using an edge detection algorithm.

[c23] The method of claim 19, further comprising the step of: Determining a fluid type associated with the at least one fluid instance based on a combination of prior knowledge of the well and the proximity of the fluid instance in relation to ideal diffusion values.

[c24] The method of claim 17, wherein the steps of identifying, integrating and computing quantitative formation evaluation values is repeated for additional fluid instances.

[c25] The method of claim 17, wherein the formation evaluation values are quantitative values associated with the fluid instance of at least one of fluid volume, saturation, viscosity, porosity and permeability.

[c26] A method for determining quantitative formation evaluation results from a multi-dimensional representation of nuclear magnetic resonance data, the method compris-

ing the steps of:
Obtaining a set of NMR data for a fluid sample;
Computing from the set of NMR data a multi-dimensional distribution using a mathematical inversion independent of prior knowledge of fluid sample properties;
Displaying the multi-dimensional distribution as an at least two-axis graph;
Identifying at least one fluid instance on the graph representing a probable existence of a detected fluid;
Computing a mean value across a region of the distribution associated with the at least one fluid instance; and
Computing a quantitative formation evaluation value based on the computed mean value.

[c27] The method of claim 26, further comprising the step of:
Eliminating from the graph fluid instances representing a probable existence of a detected fluid such that no more than two fluid instances are visible.

[c28] The method of claim 26, wherein the mathematical inversion is based on a maximum entropy process.

[c29] The method of claim 26, wherein the multi-dimensional distribution is displayed along a fluid diffusion axis and a T_2 relaxation axis.

[c30] The method of claim 29, wherein the graph includes an overlay with ideal diffusion and T_2 relaxation values.

[c31] The method of claim 29, wherein the formation evaluation values are quantitative values associated with the fluid instance of at least one of fluid volume, saturation, viscosity, porosity and permeability.